history of the organization, its proposed dates of meeting, list of members, books in the library, etc. The officers for the present year, beginning last October, are President, Prof. J. W. Caldwell; Vice-President, Rev. H. R. Johnson; Corresponding Secretary, Prof. J. G. Ogden; Recording Secretary, Miss W. L. Matthews; Treasurer, C. C. Mellor; Curator, John A. Shafer.

Reviews of Foreign Literature.

A New Theory of the Process of Growth of the Plant Cell.— In the "Berichte der Deutschen Bot. Gesellschaft" for August, 1890, pp. 196, is an article by Dr. Julius Wiesner entitled, "An Attempt to Explain the Growth of the Plant Cell." The writer states that most botanists assume that the growth of the cell and its parts takes place by means of intussusception; others discard this theory entirely and claim that the method is that of apposition; still another class try to harmonize known facts by a combination of the two theories, namely, that both methods of growth occur. Then follows a brief statement of an explanation which is entirely independent of the much-vexed question of intussusception or apposition.

This theory, if substantiated, would lead to an over-throw of several other long cherished opinions respecting not only the manner of growth of the cell but the nature of the substance composing it, and is altogether of such a revolutionary character as to warrant an almost literal translation of the article referred to.

In his explanation he first shows the analogy between growth in general and that of the smallest part of the organism; for example, the growth of an organ, leaf or stem, takes place by an increase in volume coming from the extension of a whole or part of its cells. There may be unequal development, one part growing faster than the other, but the whole organ gets its shape, size, etc., from the growth of the cells composing it. Now the cell growth is similar to this, in so far that it is accomplished by the parts composing it. Without any apparent shoving or displacement, it grows in surface, in length, and in thickness, the growth always preserving the intercalary nature of all new formation. This very idea of intercalary growth led to the notion of

intussusception. This analogy between the processes of growth in an organ and that of the cells composing it, is not merely external. All scientists agree that no living substance can originate from a dead one. That is, inside the organism all living substance must come from living. This is the first assumption or premise on which is founded the new theory.

In order to avoid misconception here, he explains, that in the process of assimilation, in its widest sense, dead substance becomes a part of living, but that this can happen only in the presence, and by the aid of living matter, so in this sense there is no objection to the hypothesis as above stated.

The second assumption is, that no other method of new formation occurs in an organism except that of division. The cell originates from the division of a cell; the same is true of the nucleus, also of the chlorophyll-grain or that from which it springs, etc., etc. The process of division is found to be so intimately connected with all living things as to lead to the conclusion that it also plays a part in processes so obscure as to be hidden from our observation. This hypothesis is closely connected with the first. Admitting these two premises we must necessarily admit that protoplasm cannot regenerate itself without a process of inner division. That is, when a meristem cell divides and its parts extend themselves, the substance being increased, this new formation is the result of the inner division of the protoplasm. Therefore the living substance of the plant, and to this is reckoned not only the cytoplasm, nucleus and similar structures, but also the cell-wall, must consist of little organized individuals having the power to divide themselves. They must also have the power to grow, else they would cease to be organized; having the power to grow implies the power to assimilate. Therefore the conclusion, "Living substance consists of small organized individuals, having the power to divide, to grow, and to assimilate."

These smallest portions of the organism he names *Plasomen*, and says in reference to their union with one another, it may be of various kinds, but probably in most cases they are so united that each is in contact with water. Now if the cell and its living parts are composed of these plasomes, as a leaf is composed of cells, then the growth of the cell must result from the growth of

its plasomes, just as the leaf or other multicellular organ grows by the volume increase of its cells.

The question how these plasomes grow, after division takes place, is answered as follows: As the masses they compose possess a large quantity of water, they are easily moved upon each other, therefore the process of intussusception is not necessary to cause their increase in volume. This increase, in case of a plasome which has just divided, may be explained in a purely physical manner. By diffusion and absorption, water holding solid substance in solution enters these little bodies and is assimilated; in this way the solid matter of the product of assimilation fixes the volume of the plasome.

The only question unanswered by this hypothesis is, "How does the dead substance, which posesses a certain molecular structure, become a part of the living unit in such a way that after a certain time it no longer posesses this structure but is an integral part of the living unit, and division again occurs?"

Just as the molecule is the final form element of lifeless matter, so is the plasome the final form element of living organism. All the processes of division occurring in the cell depend on this ability of the plasome to divide; for example, if a chlorophyll grain divide, it is not by the simple process of a part of the plasomes separating from the remaining portion, but by a sing lelayer of these units dividing.

But the growth of the protoplasm must be distinguished from that of the plasome; the latter, by growth, simply makes good its former volume, while the protoplasm grows by the increase in number of its plasomes.

This theory of the manner of growth does not exclude the notion of increase in volume by the stretching caused by pressure.

The foregoing, while not a literal translation, gives nearly the whole of this paper of Prof. Wiesner, which he says contains in brief the conclusions reached by several years of study, and while it may be regarded as an effort to consider the question of cell-growth from a new stand point, it is more especially an effort to make clear those points about which converge the new discoveries about the life and development of the cell, and particularly the meaning of the processes of division.

In the foregoing article only the questions relating to the manner of cell growth are considered, and of these the principal ones are so familiar as to need no explanation in regard to the application of the theory here set forth. In a foot-note the author says: "The act of conjugation does not refute the principle that all new formation takes place by division, as before this can occur, new cells are formed by division."

This naturally suggests another application than that made by Prof. Wiesner. The reviewer may perhaps be pardoned for briefly stating this possible application, as it seems to follow as a natural consequence of the new theory.

If this new method of growth be applied to that of reproduction, a reason is found for various facts not hitherto explained. Admitting that the process of growth consists of a division of the plasome and a subsequent increase in size by the assimilation of lifeless matter, may not the process of reproduction resemble this, except that the two halves of the divided plasome unite with the halves of other units? Thus in the case of conjugation, fusion of the two masses would mean, not simply a mingling of the micellae of the protoplasm of different cells according to the present theory, but first, a division of the plasomes of both masses, then a reunion, such that the halves of the protoplasm of one cell would unite with those of the protoplasm of the other cell. This represents the highest form, or that found in the highest plants. Next below this may be assumed the process known as rejuvenescence, a cell throws off its wall, the protoplasmic plasomes divide, then reunite, each half with that of another unit, a new wall is formed and the life processes of the original cell are repeated.

Following this in the downward scale comes the process known as asexual spore production. The plasomes of a part of the protoplasm of a cell divide, reunite as in the latter case, and thus become endowed with a new energy and have the power to germinate into a new plant. Below this comes the form of reproduction which is nearest to growth and in many cases difficult to distinguish from it, viz.: vegetative reproduction, division of masses without the union of divided plasomes with each other.

E. L. G

Second Systematic Census of Australian Plants, with Chronologic, Literary and Geographic Annotations. By Baron Ferdinand von Mueller. (Part I. Vasculares, 4to, pp. 244. Melbourne, 1889).

This is a systematic enumeration of all species of flowering plants and Pteridophyta, known at the present time to inhabit Australia. The sequence of orders is somewhat different from those used by other recent authors; Baron Mueller dividing the Dicotyledonæ into (1) Choripetaleæ Hypogynæ, (2) Choripetaleæ Perigynæ, (3) Synpetaleæ Perigynæ, (4) Synpetaleæ Hypogynæ, (5)Apetaleæ Gymnospermæ. This grouping does away entirely with the artificial class Apetalæ. The Monocotyledonæ are divided into (1) Eucalyceæ Perigynæ, (2) Eucalyceæ Hypogynæ, (3) Acalyceæ Hypogynæ. The total number of species listed is 8839. N. L. B.

Recent Research among Fossil Plants. M. de Saporta. Rev. gen. de Bot. II, 1890.

In a recent number of Nature, (Sept. 25th, 1890), J. Starkie Gardner gives a review of the above which reads as follows;— It appears that mosses were almost certainly represented in the Palæozoics, a species allied to *Polytrichum* having been discovered at Commentry in France. Rarely as the fructification of ferns is preserved in the coal-measures, twenty species are now investigated, confirming the view that the Palæozoic species differed widely from the present, the vast order Polypodiaceæ and the Cyatheæ being unrepresented. The view that the *Calamarias* were in part Gymnosperms is all but universally abandoned, and the close affinity of the *Lepidodendrons* and *Sigillarias* and their cryptogamic nature everywhere admitted. Links in the chain of evolution between Cryptogams and Gymnosperms still elude our search, and the earliest vegetation of which we have any complete knowledge already presents well-developed Gymnosperms in the shape of the deciduous *Cordaites*, a few *Cycads* and obscure *Taxads* allied to *Ginkgo*.